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(71) Applicant
Trutzschler GmbH & Co. KG (FR Germany), Duvenstrasse 82-92, D-4050 Monchengladbach 3, Federal Republic of Germany

(72) Inventor
Ferdinand Leifeld

(74) Agent and/or Address for Service
Abel & Imray, Northumberland House, 303-306 High Holborn, London WC1V 7LH

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B8A
Selected US specifications from IPC sub-class D01G

(54) Device and method for the pneumatic feeding of fibres

(57) A device for the pneumatic feeding of of carding machines through supply shafts (7) located upstream of the individual carding machines (8), has the shafts 7 connected to a common pneumatic transport conduit (6) and located downstream thereof. The conduit (6) is connected via a fan (5) to the fibre processing machines (4), e.g. the fine opener, located upstream. In order to regulate air conditions in the conduit (6) or in the shafts (7) when a batch or the number of working carding machines is changed, the air volume flow rate and/or the air velocity in the conduit 6 is adjusted – by changing the fan speed – as a function of batch-specific data or the number of working carding machines.

A control device 9 may sense electrical drive variables or displacement of flaps (11*a*-11*c*) in shafts 7 to adjust the fan motor 10. Alternatively, the flow rate is sensed, via a meter (14), to move walls (17a-17c) whereby to vary the size of the conduit 6. Again, a microcomputer 9 may analyze variables and function as a control device.

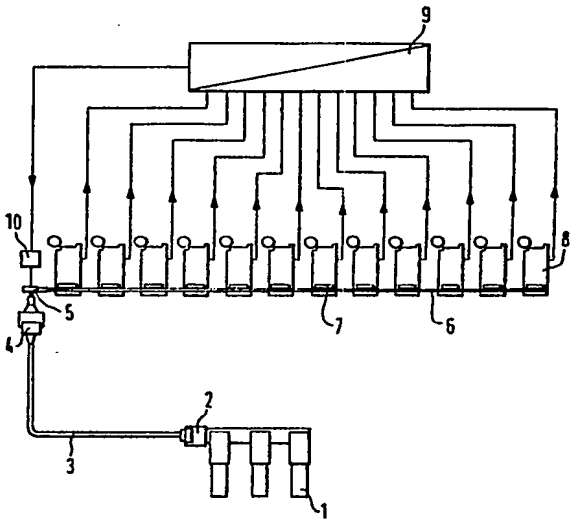

Fig.1a

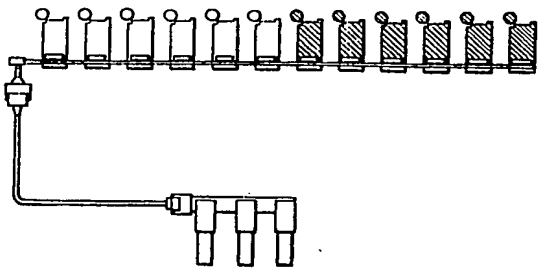

Fig.1b

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The print includes new claims filed after the issue of the search report.

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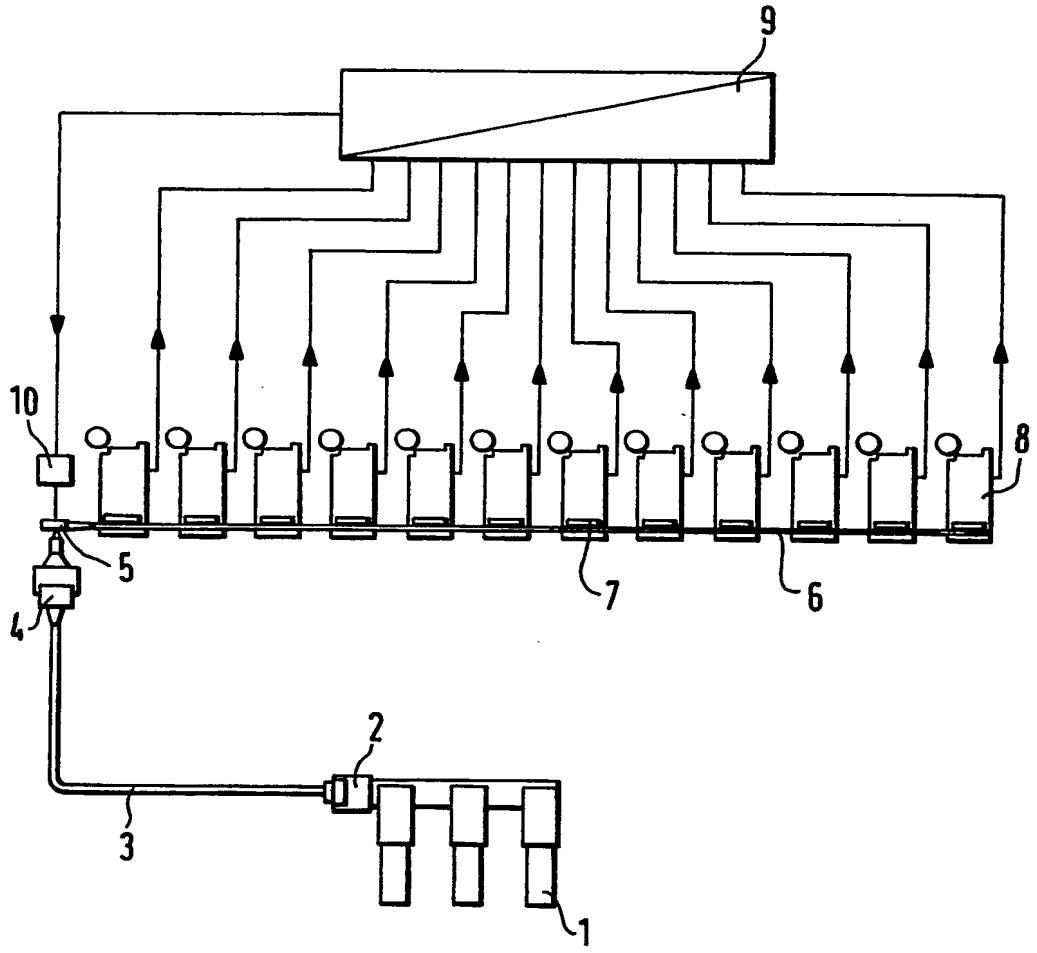

Fig.1a

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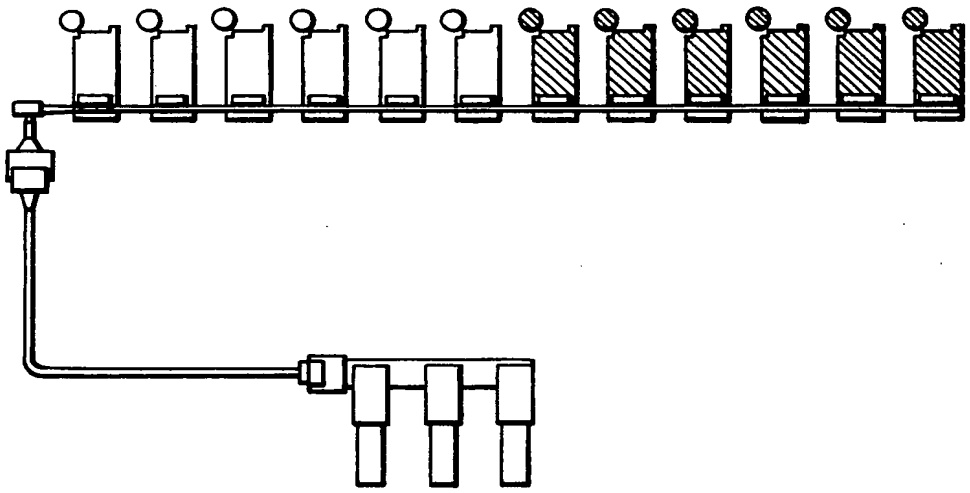

Fig.1b

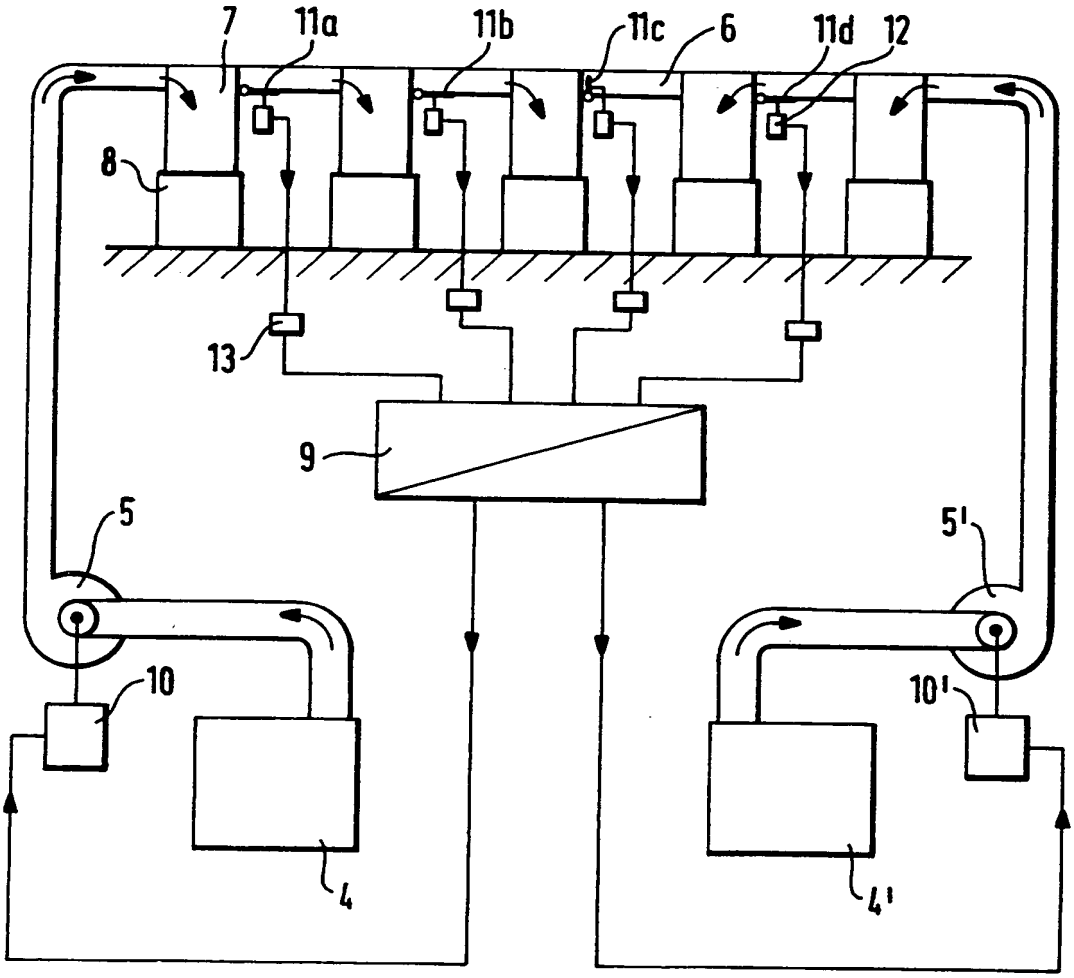

Fig. 2

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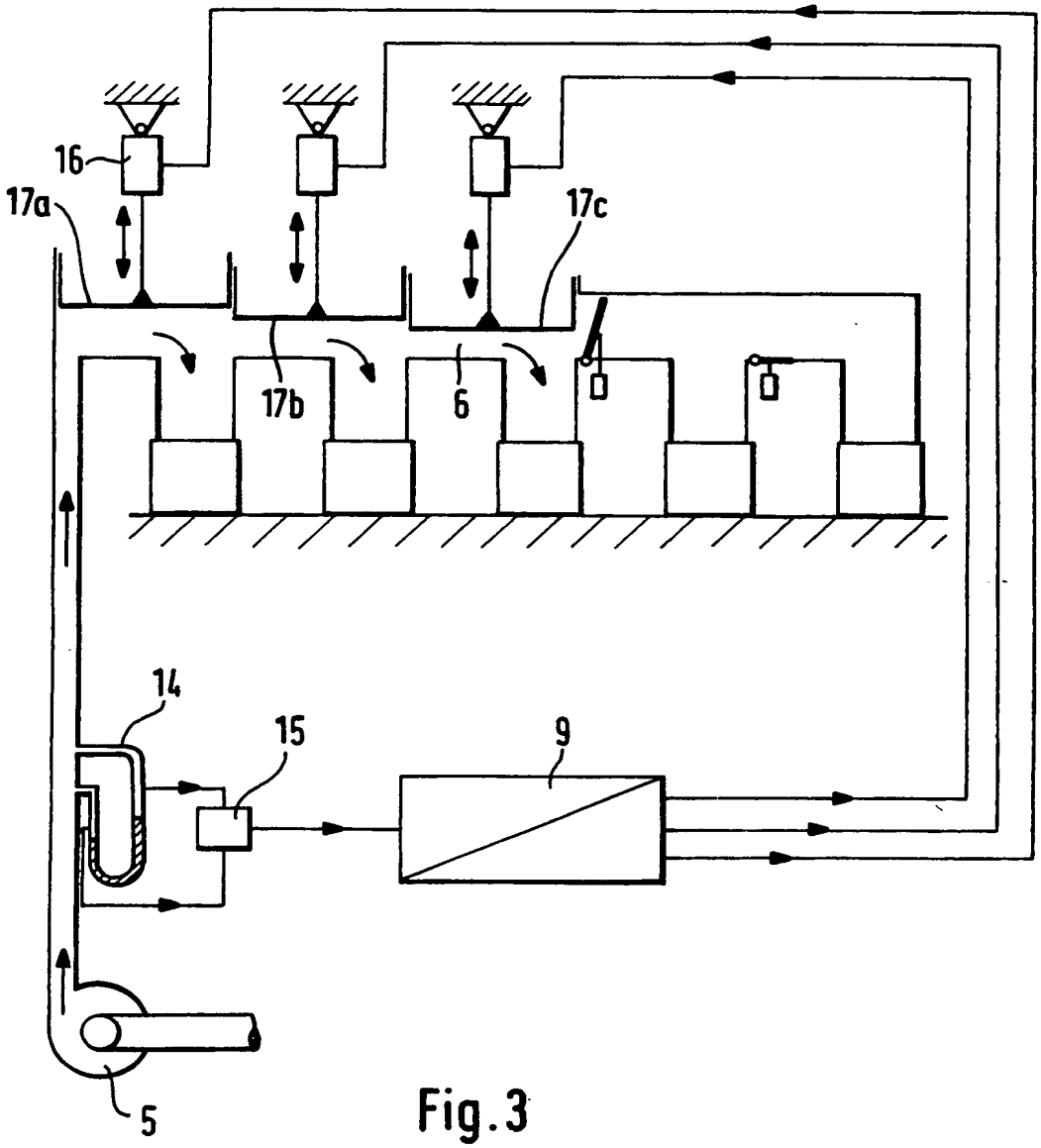


Fig.3

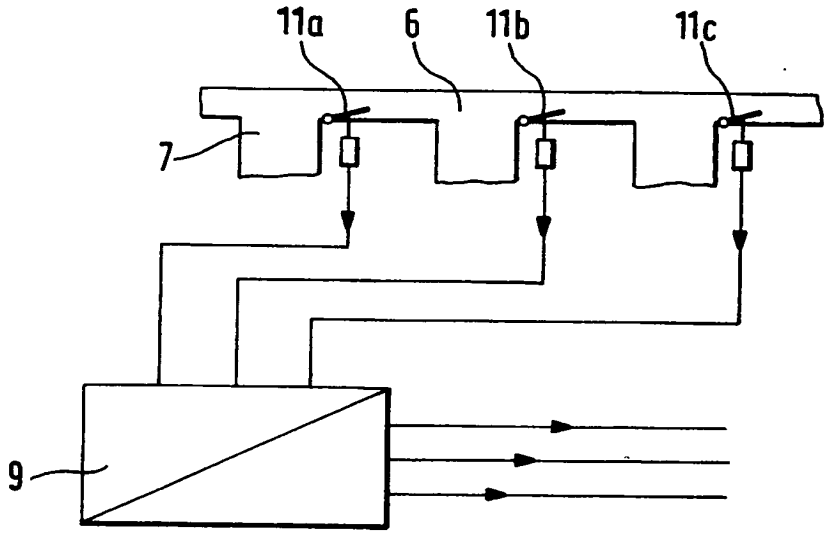
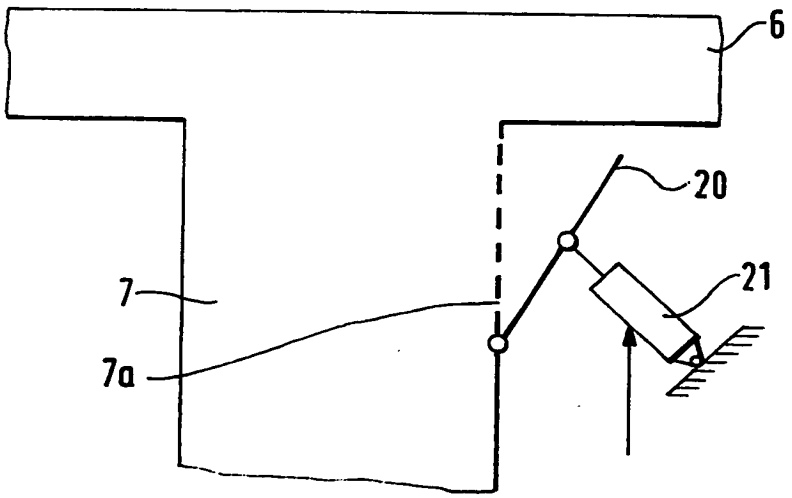


Fig.4

Fig.5



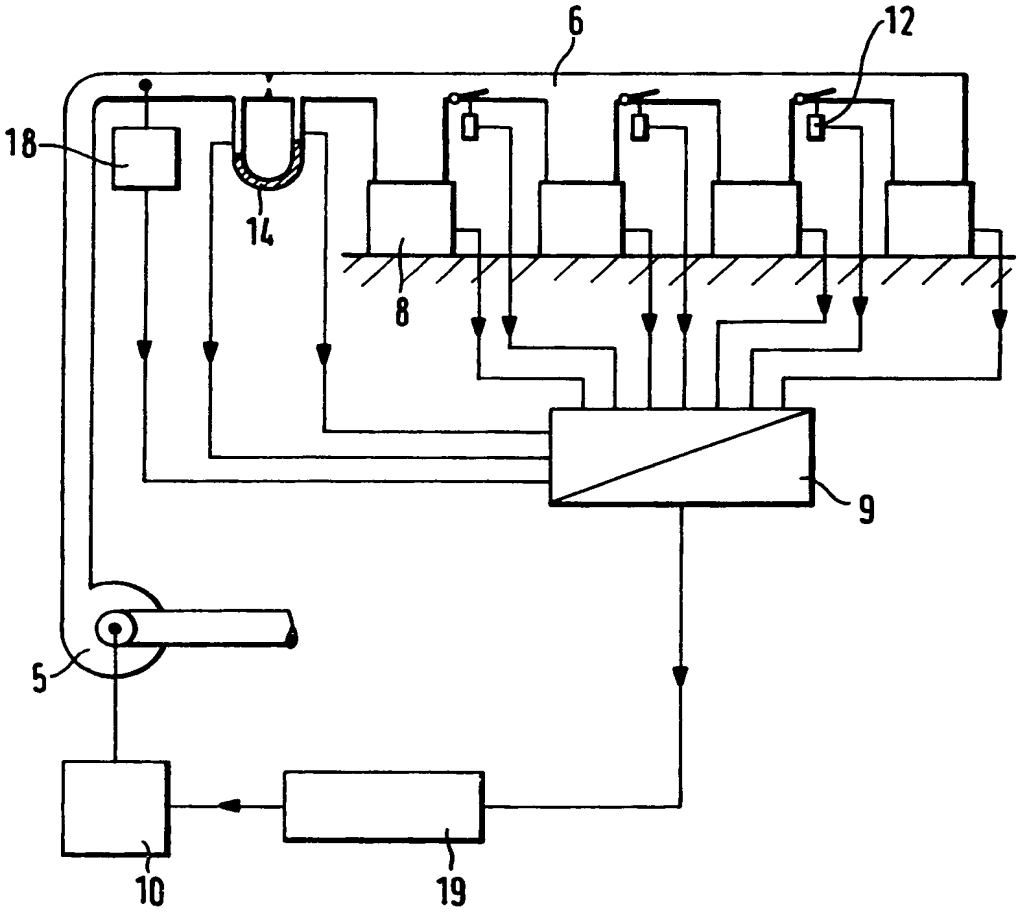


Fig.6

SPECIFICATION

Device and method for the pneumatic feeding of fibres

The invention relates to a method and device for the pneumatic feeding of fibres.

In a twin shaft card feed, as known, for example, from DE-PS 28 04 413, the filling conditions in the upper shaft should not deviate significantly from the desired standard conditions if the carding machine charge is to achieve good uniformity values in respect of width and time. Filling conditions of relevance are the amount of feed material in the upper shaft, the degree of compaction and distribution of the material and also the shape and size of the accumulation of material on the air discharge surface. The filling conditions in the upper shaft are dependent, *inter alia*, on the flock-to-air ratio, the flock size, the air resistance of the discharge area, that is to say, the shape and size of the discharge area, the transport speed of the flocks and the volume of emerging air and the air discharge velocity at the discharge region. Several of these variables are dependent on the static air pressure, the air volume flow rate and the speed in the transport conduit to the filling shafts. These in turn are determined by the operating point of the fan connected upstream, and by the filling conditions at the discharge surfaces of all upper feed shafts located downstream and by the geometry of the feed conduits. While there are fluctuations only within certain narrow limits, good results are achieved. The magnitudes of the fluctuations are determined by the number of carding machines requiring flock at a given moment, by the amount of material per location being passed through at a given moment, by the degree to which the material supplied to each location has been unravelled, and by the sliding properties and the air resistance of the material. When there are fluctuations in the output of the individual carding machines, as a result of switching the carding machines on and off or as a result of fluctuations in the density in the feed conduit, caused by the preceding station (blowing room), the filling conditions frequently change over and above tolerable limits. Modifications have to be made at several locations in order to adapt the filling conditions to changed material conditions and to the number of carding machines connected up. In practice, this generally occurs only when commissioning the plant and involves a great deal of effort. Nevertheless, even during a pre-selected and desired operating state of a system there are still fluctuations in the filling conditions caused by changes taking place during the operation; as a first example, in each individual carding machine the production speed can be altered, for example during can change, following disruption, for monitoring puposes, etc., or, as a second example, greatly fluctuating amounts of material can be fed by way of the transport fan into the supply shaft charging system.

In a known device, the basic speed of the material transport fan during the initial production of a specific batch is set for a given number of carding machines. When the batch type is changed, or if there is a change in the number of carding machines, for example as a result of modifications being made interruption to operation, switching on or off etc., V-belt pulleys have to be exchanged in order to modify the basic speed of the fan and therewith the volume of air and/or the air velocity in the transport conduit and in the supply shaft of the card feed. This device therefore has the drawback that, when changes are made in the composition of a batch or in the number of working carding machines, the air conditions in the transport conduit can be adapted to modified operations only with considerable effort. This work is time-consuming and means that running has to be interrupted for a relatively long time.

It is an object of the invention to provide a method and device for feeding fibres which substantially avoids or at least mitigates the disadvantages mentioned.

According to the invention there is provided a device for the pneumatic feeding of a number of carding machines by means of supply shafts located upstream of the individual carding machines, the supply shafts being connected to a common pneumatic transport conduit and having feeding chutes located downstream, the transport conduit being in communication by way of a material transport fan with the fibre-processing machine, for example, a fine opener, located upstream, characterised in that the amount of air and/or the air velocity in the transport line (6) are/is adjusted in dependence on batch-specific data or the number of working carding machines (8).

Because the air volume flow rate and/or the air velocity in the transport conduit are set as a function of batch-specific data or the number of working carding machines, it is possible to effect a simple and rapid adaptation of the air conditions in the transport conduit and/or in the supply shaft whenever a batch of the number of working carding machines is changed.

The term "batch-specific data" used herein refers to values of variables relating to a particular batch of fibre. Such variables may for example be the type of material or its fineness.

Advantageously, the variables of critical influence, such as batch-specific data or the number of working carding machines, are determined by measuring or otherwise and, after these variables have been evaluated, influence is exerted on the operating point of the charging fan (speed, air volume and air pressure) and, alternatively or in addition, on the size of the admission conduit cross-sections and/or the discharge surfaces at the upper supply shafts of the card feed. These changes can be carried out both automatically and in accordance with a preset program when the plant is undergoing modification and also during operation of the plant, that is to say, to even out fluctuations in the operation.

By way of example certain illustrative embodiments of the invention will be described with reference to the accompanying drawing, of which:

Figure 1 a shows schematically a plan of a flock-processing system, in which all carding

machines are processing fibre material;

Figure 1b shows the flock-processing system of Figure 1a, but when only some of the carding machines are processing fibre material

Figure 2 shows a pneumatically fed card feed system in vertical section with a control arrangement which is connected to shut-off devices at the head of each supply shaft and to drive units of material transport fans,

Figure 3 shows a pneumatically fed card feed system with control means, which is connected to arrangements for adjusting the cross-section of the transport conduit and to a flow meter,

Figure 4 shows a card feed system as in Figure 3, in which the control means is connected to the shut-off devices at the head of each supply trunk and to arrangements for adjusting the cross-section of the transport conduit,

Figure 5 shows a card feed system in which the control means is connected to a device for adjusting air outlet openings of the supply shafts, and

Figure 6 shows a card feed system having a centrol computer (control and regulating unit).

Figures 1a and 1b show a flock-blending system. From the weighing hopper feeders 1 and the attached flock blenders 2 the fibre material passes through a pipeline 3 into a fine opener line 4 comprising condenser, feed chute, fine opener and transport fan 5. The transport fan 5 conveys the opened fibre material pneumatically through the transport conduit 6 to the upper supply shafts 7 of card feeds downstream of which are arranged the carding machines. Whereas in Figure 1a all twelve carding machines 8 are processing fibre material, in Figure 1b fibre material is being supplied to only six carding machines 8, which operate at the same rate whilst the other six carding machines 8 are switched off.

As shown in Figure 1a the electrical drive arrangements (not shown) for the carding machines 8 are connected to a control means 9. From the drive arrangements, electrical measured variables are sensed (these could also be taken from the tachometer generator) which indicate the rotational speed of one or more rollers of the carding machines 8. The output of the control device 9 is connected to the drive motor 10 for the material transport fan 5. When, as shown in Figure 1b (in which the control device 9 is not illustrated), six carding machines 8 are switched off, then in accordance with the rotational speed of the six working carding machines 8 the rotational speed of the drive motor 10 is reduced such that the fan conveys a smaller volume of air. The air volume flow rate is in this manner preselected or automatically set as a function of the number of carding machines 8 switched on, a greater volume flow rate of air being set with a higher number of carding machines and a smaller rate being set for a lower number of carding machines.

Figure 2 shows a card feeding system, which may for example be that sold by us under the trademark FLEXAFEED, in which the transport conduit 6 is attached to two material transport fans 5,5' each having an opener or cleaner 4,4', so that fibre material is fed from both sides into the transport conduit 6. This system serves simultaneously to feed different types of fibre material, for example cotton and chemical fibres, into the transport conduit 6 and to process them on the carding machines 8. At the head of each card feed 7 there is provided a pneumatically operated closing flap (11a to 11d), for example operated by the pressure arrangement 12, which divides the transport conduit 6 into two zones, into which the two types of fibre material to be processed are fed. The pressure cylinders 12 are connected electrically by way of sensing transducer 13 to the control device 9, the outputs of which are connected to the drive motors 10,10' for the fans 5,5'. When the position of one or more of the closing flaps 11a to 11d is changed, then by way of the control device 9 the speed of the drive motors 10 and 10' is changed so that the fans 5 and 5' convey correspondingly more or less air. In this manner the basic fan speed and thus the volume flow rate of air is automatically adjusted as a function of the setting of the closing flaps 11a to 11d.

In the embodiment shown in Figure 3, a flow meter 14 is connected downstream of the transport fan 5 and is connected to the transport conduit. The flow meter 14 is electrically connected to the control or regulating device 9 *via* a sensing transducer 15. The outputs of the control or regulating device 9 are connected to pneumatic adjusting devices, for example pressure cylinders 16, which actuate devices for changing the cross-section of the transport conduit 6. The transport conduit 6 may, for example, have several wall elements 17a to 17c which may be shifted with respect to the opposite wall regions, so that the cross-section of the transport conduit 6 is decreased or enlarged thereby. The wall elements 17a to 17c may also be of resilient design, for example they may consist of rubber or the like, so that an advantageous seal is produced. In accordance with the design shown in Figure 3, the cross-section of the conduit 6 is adjusted by the control device 9 to produce the desired air flow rate, which is sensed by the transducer 15.

In the embodiment according to Figure 4, the control device 9 (in contrast to Figure 3) is connected to the closing flaps 11a to 11c at the head of the supply shafts 7 of the cards feeds. The cross-section of the transport conduit 6 is therefore automatically preselected by the control device 9 as a function of the positions of the closing flaps, by adjusting one or more of the wall elements 17a to 17c.

Figure 5 illustrates another method of controlling the air flow through the conduit 6 which may be used in addition to or in place of the methods already described. In one side wall each supply 7 has air outlet openings 7a which can be closed off by a flap 20 rotatably mounted at one end. The position of the flap 20 can be changed by a pressure cylinder 21. The pressure cylinder 21 is connected to the control device 9 (not illustrated) to control actuation of the cylinder 21.

In the embodiment shown in Figure 6, a pressure meter 18 and a flow meter 14 are connected to the transport conduit 6. The pressure meter 18, the flow meter 14, the drive arrangements for the carding

machines 8 and the pressure cylinders 12 for the closing flaps 11 are connected electrically *via* sensing transducers (not shown) to a central control system 9 (or regulating or computer system) which is advantageously designed as a microcomputer with microprocessors, so that the cross linkages between measured values and adjusting values can be calculated. The output of the control system 9 is connected *via* a motor drive means 19 to the drive motor 10 for the fan 5. The values for the air pressure, the air volume, the air velocity and the number of connected-up carding machines 8 are supplied individually or together to the regulating or computer system 9 which processes the data and acts to influence the speed of the charging fan 9 (as in the illustrated embodiment) and/or the cross-section of the transport conduit 6 (not illustrated in Figure 6). Advantageously, the control device 9 is allocated a data memory, (e.g. an automatic desired value setter). In the data memory are stored the required speeds, for example for the transport fan 5, when specific types of fibre material (batches) or a specific number of working carding machines 8 are involved. In accordance with this dependency the fan speed can be set or adapted manually or automatically in accordance with changes.

Advantageously, basic settings for the fan and/or cross-section of the feed conduit are preselected initially by the computer. Using this signal, an additional control adjusting variable is superimposed, the value of which is derived from the momentary deviations of the actual values for the air velocity and/or air volume flow rate and/or air pressure. The regulating device 9 operates together with a regulating device which regulates the amount of fibre flocks supplied. The regulating device 9 may also cooperate with a regulating device which scans and/or monitors and/or regulates the carding machine output.

In-the embodiment described above the fan 5 is upstream of the supply shafts 7. It will, however, be understood that the system may also be operated by suction with the fan downstream of the supply shafts 7.

CLAIMS

1. A pneumatic feeding device for feeding fibres to a plurality of machine supply shafts, the supply shafts being connected to a common pneumatic transport conduit along which fibres are to be carried in a stream of air generated by a fan, wherein means are provided for adjusting the flow through the transport conduit in dependence upon batch-specific data and/or the number of working machines to be supplied by the transport conduit, and/or the rate of working of one or more of the machines to be supplied by the transport conduit.

2. A device as claimed in claim 1 in which the adjusting means includes a control device arranged to effect the adjustment automatically.

3. A device as claimed in claim 1 or 2 in which the flow of air is arranged to be adjusted by altering the speed of the fan.

4. A device as claimed in any preceding claim in which the flow of air is arranged to be adjusted by altering the air flow characteristics of the transport conduit.

5. A device as claimed in claim 4 in which the transport conduit includes one or more elements which may be moved inwardly or outwardly to alter the cross-section of the conduit.

6. A device as claimed in claim 5 in which the one or more elements are resilient elements.

7. A device as claimed in any of the claims 4 to 6 in which the adjustment of the transport conduit is arranged to be effected by one or more pneumatic actuating elements.

8. A device as claimed in any preceding claim in which the flow of air is arranged to be adjusted by altering the air flow characteristics of the supply shafts.

9. A device as claimed in claim 8 in which the air flow characteristics are altered by opening or closing vents in the supply shafts.

10. A device as claimed in any preceding claim in which a data memory is provided for storing desired values for one or more operational parts of the feed device.

11. A device as claimed in any preceding claim in which a microcomputer is provided for controlling the adjustment of the flow of air.

12. A device as claimed in any preceding claim in which the connection of the transport conduit to one or more of the supply shafts can be shut-off and the adjusting means is arranged to receive an input signal indicative of the shut-off.

13. A device as claimed in any preceding claim in which the flow of air is adjusted by adjusting the air volume flow rate and/or the air velocity in the transport conduit.

14. A pneumatic feeding device substantially as herein described with reference to and as illustrated by Figures 1a and 1b, or by Figure 2, or by Figure 3 or by Figure 6 of the accompanying drawings.

15. A carding system including a pneumatic feeding device as claimed in any preceding claim and a plurality of carding machines each connected to receive fibre material from a respective one of the supply shafts.

16. A carding system as claimed in claim 15 in which each of the supply shafts is arranged to supply material to a respective carding machine via a respective carding machine via a respective feed shaft.

17. A system as claimed in claim 16 in which the adjustment means is arranged to be operated in dependence upon input signals received from drive mechanisms of the carding machines.

18. A system as claimed in any of claims 15 to 17 wherein the fan is a material transport fan of a fine opener line.

19. A method of pneumatic feeding of fibres to a plurality of supply shafts located upstream of respective carding machines and connected to a common pneumatic transport conduit along which fibres are carried in a stream of air generated by a fan, wherein the amount of air flowing through the transport conduit and/or the velocity of air in the transport conduit is adjusted by an adjustment

means in dependence upon batch-specific date, and/or the number of working carding machines supplied by the transport conduit and/or the rate of working of one or more of the carding machines supplied by the transport conduit.

20. A method as claimed in claim 19 in which the adjustment by the adjustment means is carried out automatically.

21. A method as claimed in claim 19 or 20 in which the flow of air is adjusted by altering the speed of the fan.

22. A method as claimed in any one of claims 19 to 21 in which the flow of air is adjusted by altering the air flow characteristics of the transport conduit.

23. A method as claimed in any of claims 19 to 22 in which the flow of air is adjusted by altering the air flow characteristics of the supply shafts.

24. A method of pneumatic feeding of fibres, the method being substantially as herein described with reference to and as illustrated by the accompanying drawings.

25. Device for the pneumatic feeding of a number of carding machines by means of supply trunks located upstream of the individual carding machines, the supply trunks being connected to a common pneumatic transport conduit and having feeding chutes located downstream, the transport conduit being in communication by way of a material transport fan with the fibre-processing machine, for example, a fine opener, located upstream, characterised in that the amount of air and/or the air velocity in the transport line (6) are/is adjusted in dependence on batch-specific data or the number of working carding machines (8).

26. Device according to claim 25, characterised in that a control device (9) is provided, the input of which is connected to the drive mechanism of the carding machines (8) and/or to the shut-off devices (11a to 11d) at the head of each supply trunk (7).

27. Device according to claim 25 or 26, characterised in that the output of the control device (9) is connected to the drive device (10) of the material transport fan (5).

28. Device according to one of claims 25 to 27, characterised in that the output of the control device (9) is connected to a device (17) for adjusting the cross-section of the transport conduit (6).

29. Device according to one of claims 25 to 28, characterised in that the adjusting device (17) has resilient elements, for example rubber elements or similar elements.

30. Device according to one of claims 25 to 29, characterised in that the output of the control device (9) is connected to a device (20) for adjusting the air outlet openings (7a) of the supply trunks (7).

31. Device according to one of claims 25 to 30, characterised in that the adjusting device (11; 17; 20) contains pneumatic actuating elements (12; 16; 21).

32. Device according to one of claims 25 to 31, characterised in that the control device (9) has a data memory (automatic control point setter) allocated to it.

33. Device according to one of claims 25 to 32, characterised in that a microcomputer is used as the control device (9).

Amendments to the claims have been filed, and have the following effect:–

*(a) Claims 1-33 above have been deleted

*(b) New claims 1-26 have been filed as follows:-

1. A pneumatic feeding device for feeding fibres to a plurality of machine supply shafts, the supply shafts being connected to a common pneumatic transport conduit along which fibres are to be carried in a stream of air generated by a fan, wherein means are provided for adjusting the flow of air through the transport conduit in dependence upon batch-specific data and/or the number of working machines to be supplied by the transport conduit.

2. A device as claimed in claim 1 in which the adjusting means are arranged to adjust the flow of air through the transport conduit also in dependence upon the rate of working of one or more of the machines to be supplied by the transport conduit.

3. A device as claimed in claim 1 or 2 in which the adjusting means includes a control device arranged to effect the adjustment automatically.

4. A device as claimed in any preceding claim in which the flow of air is aranged to be adjusted by altering the speed of the fan.

5. A device as claimed in any preceding claim in which the flow of air is arranged to be adjusted by altering the air flow characteristics of the transport conduit.

6. A device as claimed in claim 2 in which the transport conduit includes one or more elements which may be moved inwardly or outwardly to alter the cross-section of the conduit.

7. A device as claimed in claim 6 in which the one or more elements are resilient elements.

8. A device as claimed in any of claims 5 to 7 in which the adjustment of the transport conduit is arranged to be effected by one or more pneumatic actuating elements.

9. A device as claimed in any preceding claim in which the flow of air is arranged to be adjusted by altering the air flow characteristics of the supply shafts.

10. A device as claimed in claim 9 in which the air flow characteristics are altered by opening or closing vents in the supply shafts.

11. A device as claimed in any preceding claim in which a data memory is provided for storing desired values for one or more operational parts of the feed device.

12. A device as claimed in any preceding claim in which a microcomputer is provided for controlling the adjustment of the flow of air.

13. A device as claimed in any preceding claim in which the connection of the transport conduit to one or more of the supply shafts can be shut-off and the adjusting means is arranged to receive an input signal indicative of the shut-off.

14. A device as claimed in any preceding claim in which the flow of air is adjusted by adjusting the air volume flow rate and/or the air velocity in the transport conduit.

15. A pneumatic feeding device substantially as herein described with reference to and as illustrated by Figures 1a and 1b, or by Figure 2 or by Figure 3 or

by Figure 6 of the accompanying drawings.

16. A carding system including a pneumatic feeding device as claimed in any preceding claim and a plurality of carding machines each connected to receive fibre material from a respective one of the supply shafts.

17. A carding system as claimed in claim 16 in which each of the supply shafts is arranged to supply material to a respective carding machine via a respective feed shaft.

18. A system as claimed in claim 17 in which the adjustment means is arranged to be operated in dependence upon input signals received from drive mechanisms of the carding machines.

19. A system as claimed in any of claims 16 to 18 wherein the fan is a material transport fan of a fine opener line.

20. A method of pneumatic feeding of fibres to a plurality of supply shafts located upstream of respective carding machines and connected to a common pneumatic transport conduit along which fibres are carried in a stream of air generated by a fan, wherein the amount of air flowing through the transport conduit and/or the velocity of air in the transport conduit is adjusted by an adjustment means in dependence upon batch-specific data, and/or the number of working carding machines supplied by the transport conduit.

21. A method as claimed in claim 20 in which the adjustment by the adjustment means is made also in dependence upon the rate of working of one or more of the carding machines supplied by the transport conduit.

22. A method as claimed in claim 20 or 21 in which the adjustment by the adjustment means is carried out automatically.

23. A method as claimed in any of claims 20 or 22 in which the flow of air is adjusted by altering the speed of the fan.

24. A method as claimed in any one of claims 20 to 23 in which the flow of air is adjusted by altering the air flow characteristice of the transport conduit.

25. A method as claimed in any of claims 20 to 24 in which the flow of air is adjusted by altering the air flow characteristics of the supply shafts.

26. A method of pneumatic feeding of fibres, the method being substantially as herein described with reference to and as illustrated by the accompanying drawings.

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